Construction and Operation of a Floating Alaska Salmon Trap

UNITED STATES DEPARTMENT OF THE INTERIOR
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ABSTRACT

Salmon traps, now nearly extinct, are the most efficient fishing gear ever developed for the capture and impoundment of salmon. The first salmon trap was built in Cook Inlet about 1885, but floating traps were not introduced until after 1890. The number of traps varied annually until the State Legislature abolished them in 1959. In 1967, only three traps were operated in Alaska in a Federal Fishing Reserve set aside by President Woodrow Wilson for the Metlakatla Indians on Annette Island. A floating salmon trap consists of a lead, outer and inner hearts, pot, and two spillers. Methods of hanging, setting, and brailing a trap are given.

INTRODUCTION

A salmon trap is a highly efficient and specialized type of commercial fishing gear used to catch and impound Pacific salmon. Like many types of commercial fishing gear, a salmon trap is a modern version of a fishing device used by primitive civilizations. Salmon canning companies owned and operated most of the traps in Alaska.

The first salmon trap was built in Cook Inlet about 1885. It was patterned after the pound nets used in the Great Lakes fisheries but was modified considerably to withstand strong tidal currents and waves. This type of salmon trap became known as a pile trap because log-size piles were driven into the sandy bottoms to support the trap and the webbing and wire netting were fastened to piles to form the walls.

The first trap was so successful that traps soon were built in other fishing areas of central Alaska. The pile trap could only be used where the water was relatively shallow and the bottom was soft enough to drive piles.

About 1890 the salmon canning industry expanded its operations to southeastern Alaska. The pile trap could be built only in a few locations in this region because the bottom was rockier and deeper than in central Alaska. A different type of trap was required to harvest the large salmon runs. A floating trap was the answer (fig.1).

BRIEF HISTORY OF THE FLOATING TRAP

Many of the oldtime salmon canners claim that the design of the floating trap came from Norway and that Norwegian fishermen were imported to build them. Modifications were required to withstand the action of the waves and tidal currents on the unprotected coast. The floating trap rapidly increased in popularity, and soon after the turn of the century they outnumbered the pile traps nearly two to one.

The number of traps used in the fishery varied from year to year. When large salmon runs were anticipated the number of traps increased, and when small runs were expected the number decreased. The large decline of traps in 1954 (table 1) was a result of vigorous conservation measures to restore salmon stocks that were declining. Severe restrictions were also placed on other salmon gear, and in addition many areas were closed to commercial fishing.

Traps catch all species of salmon, but mostly pinks, chums, and sockeyes. The species taken depends generally on the location of the trap.

The use of salmon traps was a controversial issue for many years. Because traps were so efficient (a trap in a good location could catch up to 100,000 salmon in a single day), many Alaskans believed that traps caused declining salmon runs. Fishery biologists did not know at that time that salmon born in North American streams were intermingling in the high seas

Figure 1.–A floating trap in southeastern Alaska.

with salmon born in Asiatic streams and were being captured by foreign nations engaged in high seas fisheries. Twice the people of Alaska voted in referendum for trap abolishment. In 1948 the vote was 19,712 for abolishment and 2,634 for retention. Again in 1956 the vote was overwhelmingly for abolishment–20,872 to 3,946. Alaska was a Territory and the people's choice did not become law, but their choices were presented to the Congress of the United States and the Secretary of the Interior as moratoriums. On November 8, 1958, the Secretary of the Interior notified the salmon industry that traps in Alaska, except those owned by Indian tribes on reservations, would be phased out in succeeding years. In 1959, however, control of fisheries was turned over to the new State of Alaska, and the first session of the State Legislature abolished all traps, except those located on United States Fishery Reserve and operated by the Metlakatla Indians of Annette Island in southeastern Alaska. President Woodrow Wilson set aside the U.S. Fishery Reserve on April 28, 1916. In 1967, three traps were operated under Federal supervision of the Bureau of Commercial Fisheries (Fred Headlee, personal communications).

LEGAL PROCEDURES FOR TRAP FISHING

Before Alaska outlawed the traps, it was possible to build and operate this gear if certain procedures were followed. Four prerequisites were necessary before a trap could be installed and fished on a site: (1) Find an unclaimed location, that is, a site on which no one had prior rights to fish; (2) secure a permit for the location from the Army Corps of Engineers, which is responsible for keeping the waters open for navigation; (3) buy a license for the trap from the Territory of Alaska; and (4) file a notice of intention to fish the site with the nearest office of the

Table 1.–Floating and pile traps operated in southeastern and central Alaska, 1930-64.

Year	Southeastern Alaska			Central Alaska			Annual total
	Floating traps	Pile traps	Total	Floating traps	Pile traps	Total	
	Number			*Number*			
1930	381	63	444	42	213	255	699
1931	234	40	274	25	177	202	476
1932	171	22	193	22	127	149	342
1933	242	19	261	19	119	138	399
1934	262	28	290	35	134	169	459
1935	250	30	280	33	134	167	447
1936	254	30	284	30	139	169	453
1937	252	32	284	31	138	169	453
1938	257	29	286	33	137	170	456
1939	262	23	285	32	126	158	443
1940	255	20	275	30	126	156	431
1941	230	19	249	13	119	132	381
1942	251	19	270	27	120	147	417
1943	239	15	254	16	108	124	378
1944	247	17	264	23	110	133	397
1945	251	14	265	27	118	145	410
1946	262	11	273	27	120	147	420
1947	256	11	267	27	128	155	422
1948	231	11	242	27	130	157	399
1949	210	6	216	27	110	137	353
1950	240	7	247	28	117	145	392
1951	242	10	252	26	108	134	386
1952	194	11	205	20	109	129	334
1953	247	9	256	15	104	119	375
1954	113	5	118	1	97	98	216
1955*			113			90	203
1956*			122			125	247
1957*			123			92	215
1958*			146			97	243
1959	11	–	11	–	–	–	11
1960	11	–	11	–	–	–	11
1961	11	–	11	–	–	–	11
1962	11	–	11	–	–	–	11
1963	4	–	4	–	–	–	4
1964	4	–	4	–	–	–	4

*Breakdown by type of trap was not available for 1955-58.

Sources: Alaska Fishery and Fur Seal Industries, 1930-54.
Fishery Statistics of the United States, 1955-64.

U.S. Fish and Wildlife Service. The Territory of Alaska used the following rates for licensing traps:

1 to 3 traps, pile or float	$1,200
4 to 10 traps pile or float	1,800
11 to 20 traps, pile or float	2,400
21 to 50 traps, pile or float	2,800
51 traps and over, pile or float	3,200

As traps now are illegal in Alaska, the State has no schedule of fees for trap operation. The few remaining traps are on a Federal Fishery Reserve and are not subject to licensing by the State.

The U.S. Department of the Interior, Fish and Wildlife Service, Alaska Fisheries Division, and later Bureau of Commercial Fisheries, managed and enforced the fishery regulations until Alaska became the 49th State. Enforcement agents used patrol boats and amphibious airplanes to enforce regulations. Regulations restricted the distance between traps, the distance from a river or spawning stream, the fishing season, and weekly closure periods. The purpose of the regulations was to permit some salmon to reach their spawning ground. Traps on location during the weekly closure periods and after closing of the season had to be made inoperative by the following prescribed method: "Poles shall be permanently secured to the webbing at each side of the mouth of the pot tunnel and shall extend from the tunnel floor to a height at least 2 feet above the water. A draw line shall be reeved through the lower ends of both poles and the top of one, and the upper end of this line shall be spliced to a length of chain. The two tunnel walls must be overlapped as far as possible across the pot gap and the draw line must be pulled tight so as to completely close the bottom of the tunnel. The pole of the right side of the pot gap, as viewed from the shore, must be painted bright red above water and the pole of the left bright green (fig. 2). Serially numbered seals issued by the Fish and Wildlife Service shall be affixed around the top rib lines and webbing of both tunnel walls next to each pole and a link of chain must be included in one of the seals. Seals must be attached in such manner that the trap cannot be fished without breaking them."

To make the trap inoperative within 24 hours after the season closes the trap wire on the entire wall of the inner heart from the pot tunnel to the first heart gap shall be cut down. The tunnel from the pot to the spillers must be disconnected and the spillers raised to within 4 feet of the surface within 48 hours after the beginning of a seasonal closed period.

COSTS

The cost of building and maintaining a trap depends most upon its location. Traps in the open unprotected ocean had heavier construction than traps in protected waters. As far as I know, traps have not been built since 1955, but the cost at that time was about $25,000 for a heavily constructed trap and about $15,000 for a lightly constructed one. Maintenance cost averaged from $5,000 to $6,500 annually. The investment was generally returned quite quickly because traps took large catches of salmon.

PARTS OF A FLOATING TRAP

A floating trap ready to fish consists of the following parts: (1) The lead, often called the fence; (2) the frame; (3) outer heart; (4) the inner heart; (5) pot or crib; (6) spillers, one on each side of the pot; (7) watchman's cabin (fig. 3). A trap has three tunnels or entrances–one from the inner heart leading into the pot and two from the pot each leading fish into a spiller.

Lead

The lead is an underwater wire fence suspended from a 1½-inch diameter steel cable extending from the shore to the pot tunnel of the trap. Usually the lead is anchored to shore by fastening the cable to the butt of a large tree or stump. The cable is held at the surface with closely spaced wood floats (fig. 4). The wire fence is of 3- by 6-inch mesh of No. 16 wire. The fence begins where the water depth is about 25 feet at low tide. Beginning at a depth of 6 feet the fence tapers down to 42 feet at the outer heart. The fence is tied to the cable with top end of rib lines interwoven in the wire meshes, and large rocks are tied to the bottom end of rib lines to keep the fence in a vertical position. Salmon traveling in shallow water near the shore see the lead, turn outward, and follow it into the outer heart.

Frame

The frame is about 110 by 180 feet and is usually of spruce or cedar logs that differ in size depending on where the trap is located. Traps in the open coastal waters require sturdier logs than traps in protected waters. Logs used for open areas average 42 to 36 inches diameter at the butt, tapering to about

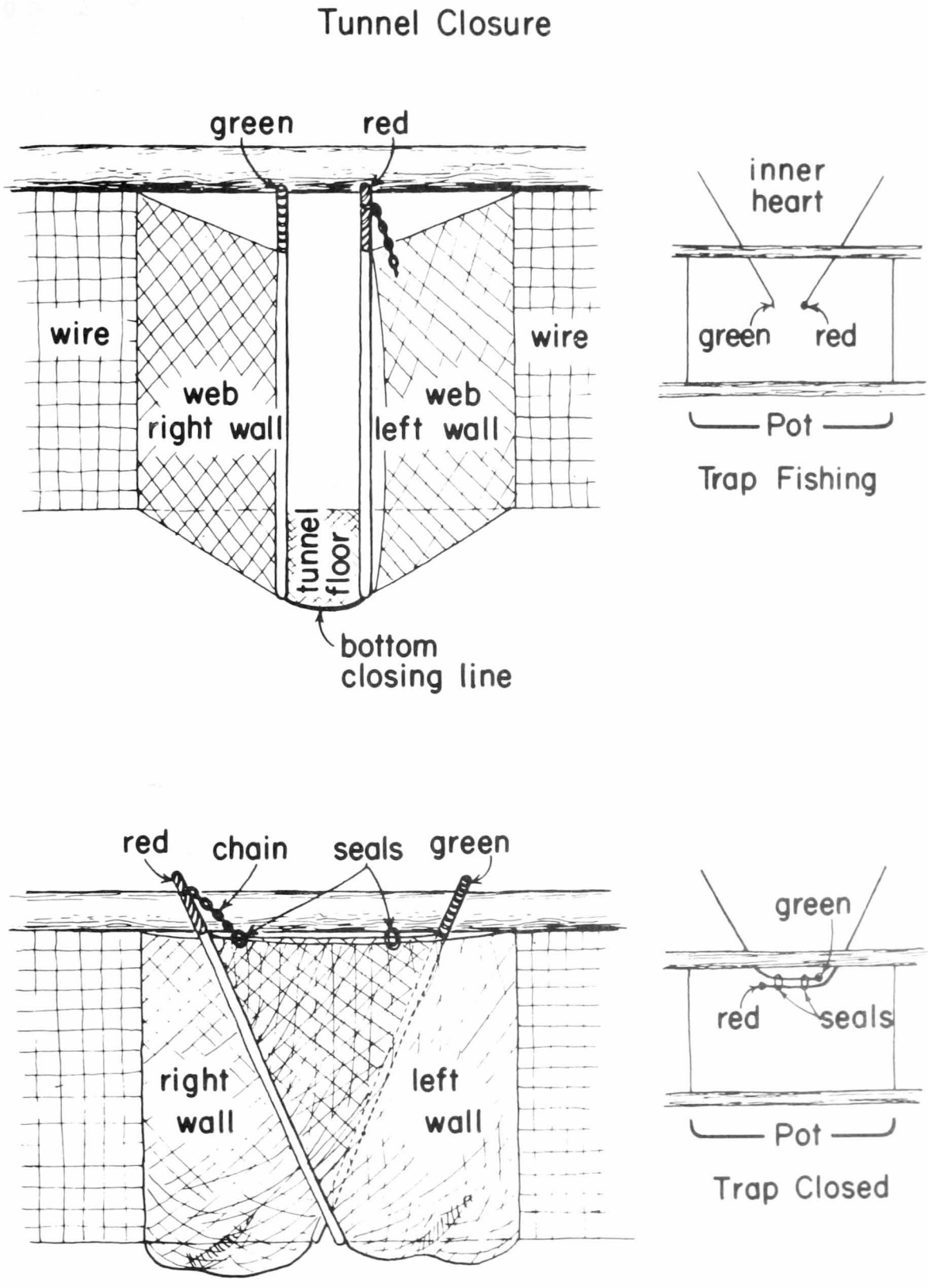


Figure 2.–U.S. Fish and Wildlife Service prescribed method of weekly trap closure to permit salmon to proceed to their spawning grounds.

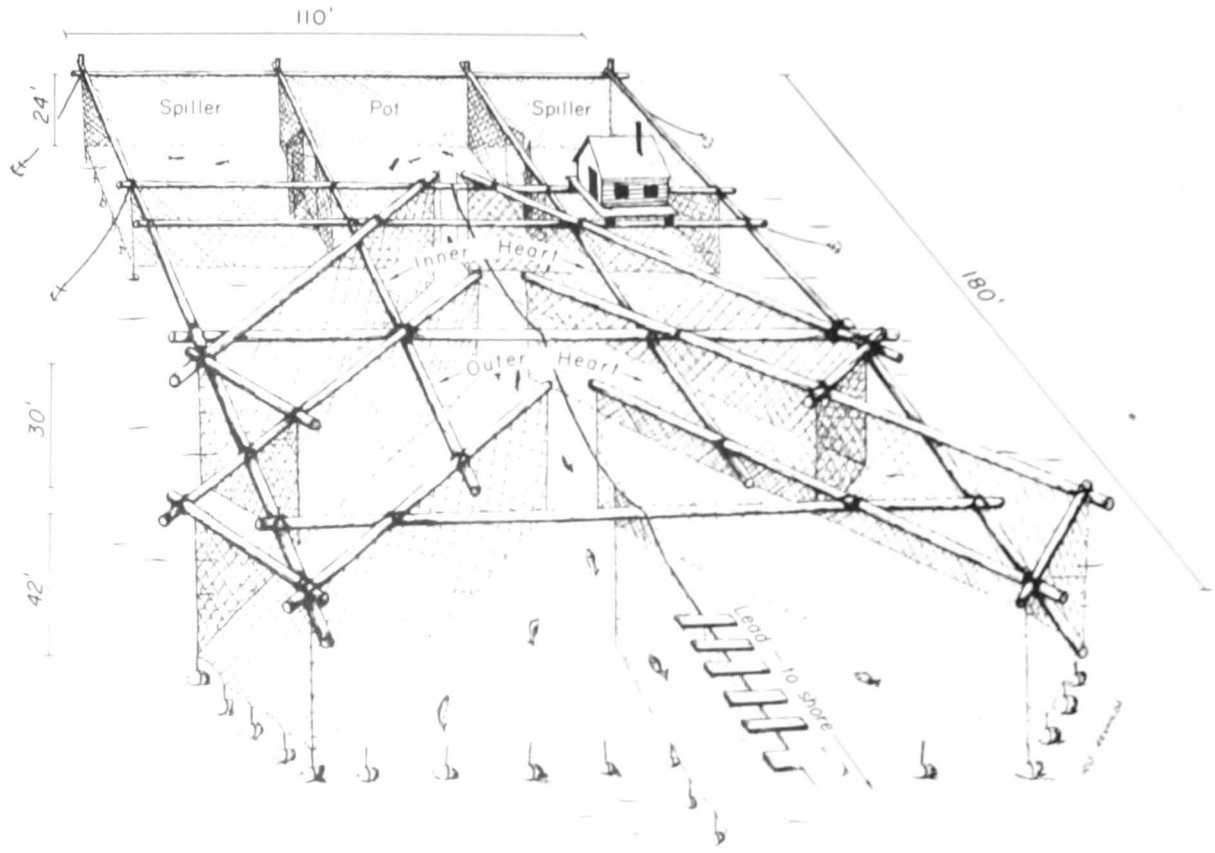


Figure 3.–Artist's conception of a floating salmon trap. A general idea of frame construction can be determined from this sketch; however, it shows fewer support logs and more rock anchors than are usually used.

32 inches at the small end. The ends are bolted together to make a solid frame, and many support logs (cross logs) are used to brace the frame. Support logs are lashed to the framework with cable. The top side of the logs are hewed flat with an ax or adze to provide a walk. The logs can be used until they become waterlogged, which means 5 to 8 years of use.

Outer Heart

The outer heart is the first compartment that the salmon enter. The floor of the outer heart is 42 feet below the water surface at the entrance and slopes upward to 30 feet at the entrance of the inner heart. Trap wire of 2- by 4-inch mesh of No. 15 wire is used for the walls and floor. The floor is attached to the walls, which are stapled to the log frame. Outer and inner hearts are V-shaped and have the same outside dimensions–about 110 feet wingtip to wingtip and about 60 feet down each side. The opening into the outer heart extends about 3 feet on each side of the lead.

Inner Heart

The inner heart is often called the small heart. Rib lines are interwoven in the wire meshes of the walls and floors and are tied to cleats that are attached to the sides of the log frame of the inner heart. (Cleats attached to the frame may be seen in the right lower center of figure 4.) This modification allowed the floors and walls to be lifted in conformance with the Sunday Apron Law passed by Congress in 1924 to permit the passage of salmon to their spawning grounds during weekend closed periods of fishing, and to make the trap inoperative before the opening and after the closing of the season. Trap wire used in the inner heart is 2- by 3-inch mesh of No. 14 gage. The floor slopes upward from a depth of 30 feet, at the outer heart, to 24 feet at the entrance to the pot.

Figure 5.–The tunnel with gate leading from the inner heart to the pot is V-shaped and its top outline can be seen just left of center. A tunnel from the pot to a spiller, which is held open with extended rib lines, can be seen in lower right center.

Pot with Tunnels and Gate

The entrance from the inner heart into the pot is about 10 feet wide on each side of the lead and narrows to about 3 feet at the gate in the pot. As the tunnel and gate combination is made of pliable webbing, the pot can be closed off during weekend closures to give salmon a chance to find their way out of the hearts and proceed to their spawning grounds. (The tunnel and gate outline, which is V-shaped, can be seen in the lower left of figure 5.) The floor of the pot is 24 feet from the water surface. Heavy gage trap wire 2- by 3-inch mesh of No. 14 gage is used for walls and floor. The pot is located at the offshore end of the trap with a spiller on each side.

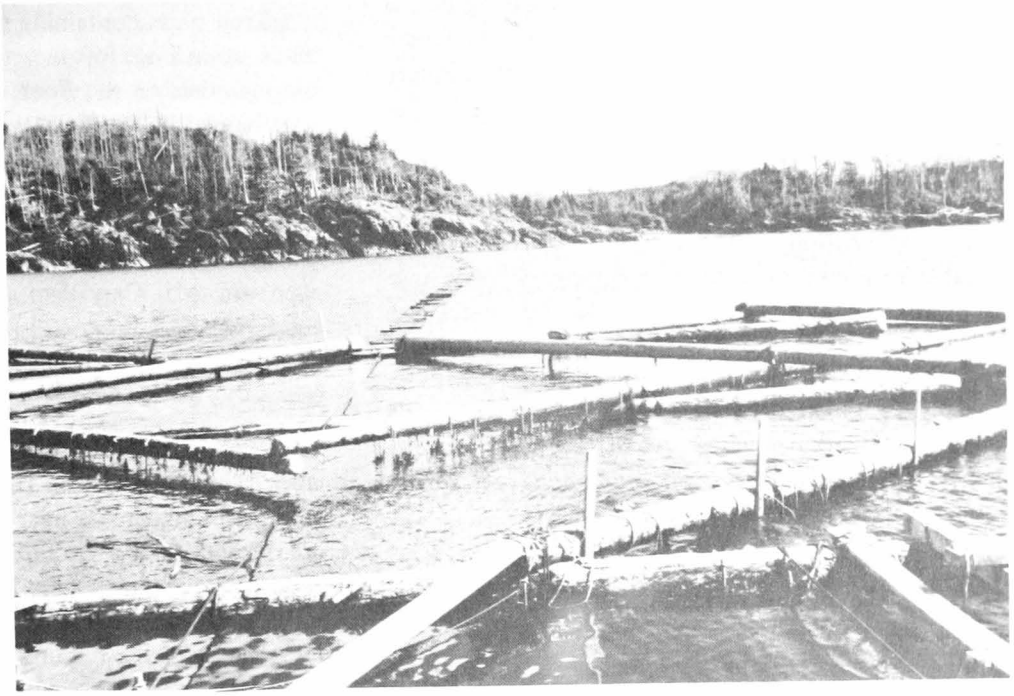
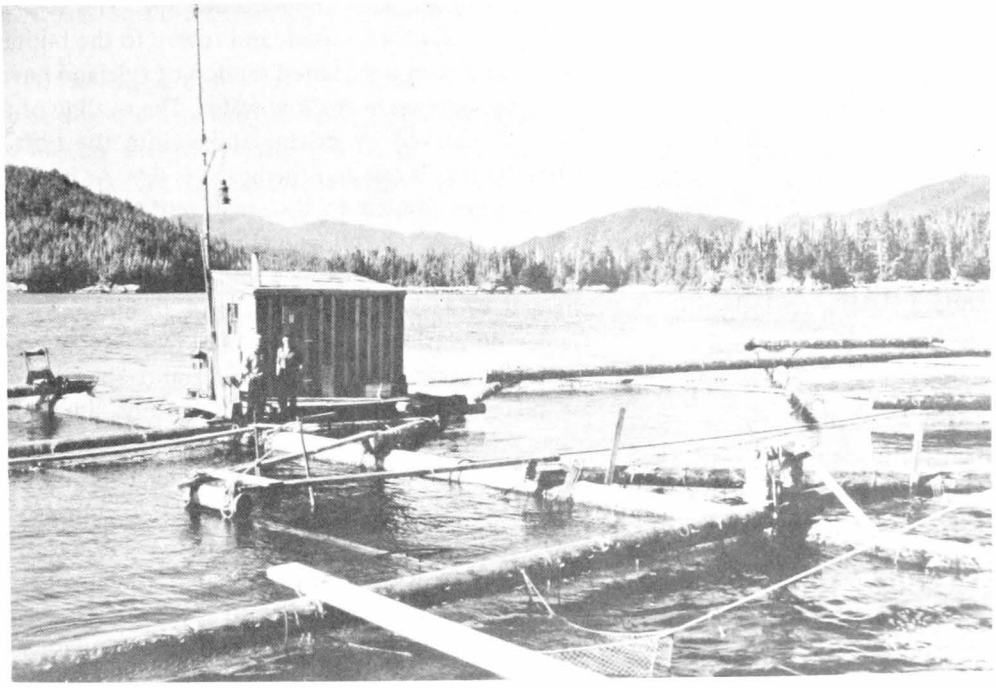


Figure 4.–View of the lead from trap toward shore.



Spillers

No trap may have more than two spillers or holding pens. From the pot, salmon enter a spiller through a tunnel of pliable webbing. When the watchman believes that enough salmon are in one spiller, he then closes its tunnel and opens the one to the other spiller. The tunnel is always closed when the spiller is being emptied. (A tunnel leading into a spiller from the pot can be seen in lower right center of figure 5.) The walls and bottoms in the spillers must be flexible as they are lifted to concentrate the fish at one end of a spiller before the trap is brailed. Generally 2- by 3-inch mesh cotton or manila webbing of No. 46 thread is used for the floor and walls. All cotton and manila webbing should be treated with creosote. (Nylon webbing, which is now available, would be easier to handle and would last longer and require no treatment.)

The sides of the spiller are framed with boards to ease the skidding of a large plank capable of supporting workmen while they drive salmon forward before brailing. (See section on brailing a trap for more explanation.)

Watchman's Cabin

A prefabricated cabin about 8 by 10 feet is on one side of the trap between a spiller and the inner heart (figs. 1 and 5). Additional logs are added to that area of the trap to keep the cabin above the water. The cabin has a stove, table, chairs, and bunks. Two watchmen are generally assigned to each trap and remain on the trap during the fishing season. An additional cabin is often built on shore for watchmen to use during severe weather. A small boat is provided so that watchmen can keep drifting material from the trap and get to shore in case of emergencies.

CONSTRUCTION OF A FLOATING TRAP

A floating salmon trap is constructed in four stages: (1) Fabricating the wire netting and webbing; (2) building the frame; (3) hanging the trap, which involves attached compartments made of wire netting to the frame; and (4) setting the trap.

Fabricating Wire Netting and Webbing

All wire netting used in traps is called trap wire. It is similar to chicken wire and fencing wire and comes in rolls of 200 feet long by 6 feet wide. Trap wire is used for the lead, walls, and floors in the outer and inner hearts and pot. All trap wire is replaced each year.

Creosoted cotton webbing (3-inch mesh, No. 46 thread) is generally used for walls and floors of the spillers and for the tunnels. Some trap owners prefer webbing heavier than No. 46 thread and have used up to No. 96 thread.

Trap parts containing trap wire and webbing are made up in a net loft or warehouse. Workmen lay out the materials on the floor, cut, and attach the pieces together with hog rings until the walls and floor of each compartment are the proper size. Rib lines are attached to the webbing of the spillers. After all the pieces have been attached with hog rings, the compartments are folded accordion style over lengths of rope and tied. They then are ready to be fastened to the frame.

Building the Frame

Construction of the frame involves considerable labor. Logs used in the frame are generally selected from standing timber near the shoreline. Spruce logs are preferred and should measure from 36 to 42 inches in diameter at the butt, tapering to about 32 inches at the small end. Any log having good buoyancy and the required dimensions may be used. The number of logs required for the frame depends on the availability of buoyant logs with the proper dimensions. Workmen fell the trees, cut them to desired lengths, and number each log. The logs are hauled to the water, rafted, and towed to the building site, which is in a sheltered section of tideland having a smooth bottom in shallow water. The outline of the frame is marked by driving stakes into the bottom when the tide is out and the beach is dry. At high tide the logs are floated to the stake outline and tied to the stakes. On the following low tide, holes are bored near the ends of the logs and the logs are either chained or lashed with cable end to end until the frame dimension (180 by 110 feet) is reached. Generally three large logs, in addition to the end logs, are placed crosswise extending from one side to the other where the trap compartments are joined together. After completion of the frame outline, the framework of the hearts then is put together with small logs and lashed with cable to the frame logs. Support logs for strengthening the framework are crossed over the entire frame of logs and lashed with cable, at each crossing, to the log directly underneath. This process is continued until the frame becomes

rigid enough to withstand waves and tidal currents without changing its shape. Figure 4 shows the small logs used in the hearts and the support logs that are crossed over and lashed with cable. The logs on top of the frame are smoothed off on the topside with an ax or adze to provide a flat walking surface.

Hanging a Trap

As mentioned earlier, hanging a trap means to attach the compartments made of wire netting to the frame. During high water the frame is moved off the staked outline. At low tide the walls and floors, which have been prefabricated, are spread out on the tideland with ropes placed underneath so the ropes can be tied to the frame to hold up the netting while the trap is being towed to its location. On the high tide, which follows, the frame is moved back into the staked outline and the netting (walls and floors) are attached to the frame. The trap may be moved on and off the staked outline several times before the hanging is finished. The lead is not attached until the trap is set.

Setting a Trap

After the trap is hung, it is towed to its location by a vessel. Setting a trap requires a towing vessel, a rigging scow, and a flat-topped scow. The rigging scow carries the lead cable and large anchors, either ship type or cement blocks, which weigh up to 7 tons each. The flat-topped scow carries the lead netting, lead floats, and the webbing for the spillers.

Anchoring a trap.--When the location is reached, one end of the lead cable is made fast at the center of the log on the shoreward end of the pot, and the opposite end is fastened to a shore anchor, which may be a large tree or stump. The trap is then towed outward from shore until the lead cable is taut. The towing vessel maintains a steady strain on the trap while the rigging scow sets the large anchors holding each corner of the trap in position.

Releasing the netting and webbing.--Workmen attach wire baskets filled with rocks to the rib lines at the corners of each compartment to lower the floors in the hearts and keep the walls vertical. The lines holding up the netting then are released, and the floors sink to their fishing depth. If difficulty is experienced in lowering the floors, workmen have to get into the water and force the netting down. Often additional large rocks are attached to the foot of the walls. The webbing for the spillers, walls, and floor is fastened to the frame by tying rib lines to cleats. Anchors or large rocks are attached to each corner of the webbing to hold the walls in a vertical position. The gate and tunnels are set in place, and rib lines are pulled taut to hold open tunnels leading from the pot to the spillers.

Attaching floats and lead netting.--Cedar floats, made from 6-foot long pieces of dry cedar logs split one-quarter round, are stapled to the lead cable about every 3 feet from near the shore to the outer heart to hold the lead cable at the surface. The lead netting, which was prefabricated, is unfolded and tied to the cable with top ends of the rib line and the opposite ends tied to large rocks. Trap operators have tried to attach the lead netting at the time of hanging the trap but have abandoned this procedure because drift-wood and other floating objects made towing the trap too difficult. When the lead is completed the trap is ready for fishing.

OPERATION OF A TRAP

Men who live on a salmon trap and operate it are called trap watchmen. Generally the two men do not know each other before assignment to the trap. This procedure is a precautionary measure to discourage collusion–selling salmon to fishermen.

Duties of Trap Watchmen

The watchmen perform six duties: (1) Guard the trap 24 hours a day throughout the fishing season from thieves, (2) remove debris from all parts of the trap, (3) close the tunnel to a spiller that is full of salmon and open the tunnel to the other spiller, (4) radio the cannery or owner about the weather and the estimated number of salmon in the trap, (5) open and close the trap in accordance with regulations, and (6) assist in brailing the spillers.

Brailing a Trap

A trap is generally brailed each day during the fishing season when the weather is favorable. A brail is used to remove salmon from a trap. The brail is generally a large apron of pliable webbing (fig. 6), which is reinforced with rib lines, and has pieces of iron pipe extending the width of the apron at both

Figure 6.–Workmen drive the fish into the offshore part of a spiller before brailing. The plank holding the workmen is skidded along the wooden frames on the sides of the spillers. A fish scow, which will carry the salmon to the cannery, is tied to the offshore edge of a spiller.

ends. A bridle is attached to one pipe so that the brail can be raised and lowered by a line supported from a large swinging boom on the cannery tender or vessel.

Preparations before brailing require all hands aboard the vessel and the two trap watchmen. The tunnel from the pot to the spiller is closed while the fish scow is positioned on the offshore end of a spiller. One end of the brail is fastened to the fish hold of the fish scow. The spiller floor is raised at the inshore end and worked toward the opposite end to drive salmon into a small area. This operation is performed by men on a sturdy plank that is skidded toward the fish scow (fig. 6). When the fish have been concentrated, a rib line, which is attached to the spiller floor, is looped over pegs in the plank to prevent the spiller floor from falling back in the water. The spiller is now ready for brailing.

The following procedure is repeated until either the spillers are empty or the fish scow is full. Men pull on lines attached to the brail to guide it in position while the brail is lowered into the spiller (fig. 7). The brail then is raised, and salmon are spilled into the fish scow (fig. 8).

After the salmon have been brailed, the spiller floor is lowered, the spiller walls are retied to the cleats, and the tunnel to the spiller is opened. The vessel with the fish scow departs for the next trap or heads back to the cannery where the salmon are canned within 24 hours after brailing.

Dismantling a Trap

Following the seasonal closure a trap must be dismantled before it is towed to off-season storage. Pliable webbing, which is used for several seasons, is removed from the trap before the trap is moved. All the wire netting is cut from the frame and discarded. The netting on the lead is also discarded because wire netting is usable only for one season. The cedar floats, which will be used again, are removed from the lead and are stacked on the flat-topped scow. The lead cable is unfastened from the trap and transferred to the rigging scow and rolled onto a cable reel after the shore end is unfastened from the tree or stump. The large anchors are then raised and placed on the deck of the rigging scow while the tow vessel prevents the frame from drifting over the anchors. After the

Figure 7.–Workmen guide the brail into the spiller.

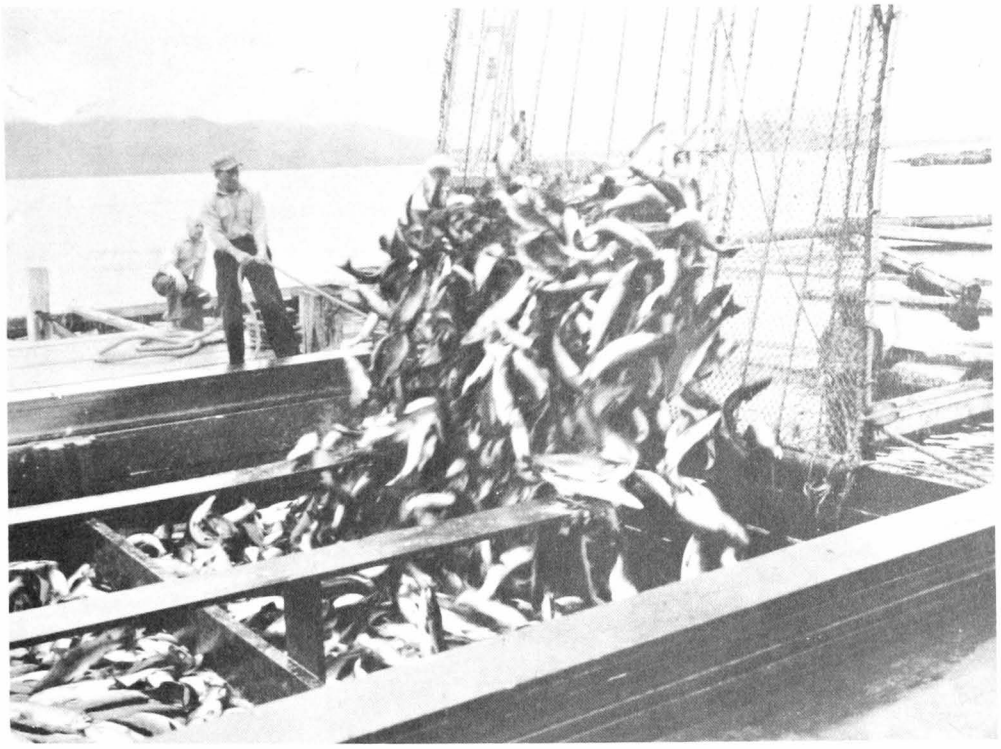


Figure 8.–A brail full of salmon is being spilled into the hold of a fish scow.

anchors are raised, the trap is ready to be towed to the storage cove.

Storage

Trap owners generally lease or own the sheltered tideland where the trap was constructed and is stored during the off season. All traps owned by a company, operating in one area, are stored in the same cove. A full-time watchman is employed to protect the company's property and premises. On a high tide, the trap is moved as close to the beach as possible. This procedure allows the frame to be out of the water part of the time and extends buoyancy life of the logs. The cedar floats are removed from the scow and are placed under cover to dry during the winter.

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